Demand
Elasticity
Exchange
Economic Aspects of Policy
Factual Background
Farms and Farm Production
Agribusiness
Historial Developments
Demographic Concepts
Skills
Index Numbers
Elasticity Coefficients

Exhibit 5

Agricultural Economics 101
Behavioral Objectives

I. Economizing
The student will be able to:
1. Explain economizing in terms of input-output relationship.
2. Explain the meanings (in the study of economics) of scarcity, resource, allocation, and ends or goals.
3. Explain a few simple applications of economizing by a farm manager, a consumer, a marketer.

II. Economic Organization
1. State the basic economic questions facing any society.
2. Describe the three basic types of economic systems.
3. Distinguish between private and collective (public) consumption.
4. Describe the basic requirements of a "market" economy.
5. Indicate some of the simple relationships of resource distribution to production and to consumption.

Editor recipient of Life Membership from Society – Thanks fellow NACTA members.

EVALUATING TODAY'S AGRONOMY CURRICULUM

H. S. Jacobs, Kurt Feltner, and O. W. Bidwell [1,2]

Our universe is really six worlds according to Chemist and Dean Henry Eyring[3]:

the minute world of the atomic nucleus and atomic bomb . . . the world of chemistry made of atoms and molecules . . . the world of the living cell and biology . . . the world of everyday (of people, nations, and social problems; of plants, food, and production and distribution problems; of natural resources and ecological systems) . . . the world of stars extending millions of miles . . . the eternal world with neither beginning nor ending of space and time.

Faculties intensively trained in the worlds of chemistry and biology tend to forget that more than 80 percent of agriculture and agronomy graduates will serve primarily in the world of everyday. Few will work with the atoms and molecules of chemistry and cells of biology but all will live in the world of everyday.

The 21-year-old student of 1971 will be 50 years old in 2000 and in the prime of life and influence. Today's curriculums should prepare students to work, learn, recommend, influence, and legislate among the dilemmas and problems of the 21st century.

Educational Objectives

Curriculums need to be living pathways in preparing the rising generation to serve individual and societal needs. Curriculum requirements and focal points should be regularly updated to meet human need and to insure reward for individual effort. Society's needs are not always clear but few will disagree that they include:

1) Increased food and fiber worldwide. Figure 1 shows that world population (3) is expected to rise from 3.5 to 6.1 billion between 1970 and 2000. Need for food should increase more dramatically because a larger percentage of the 21st century's people than of the 20th century's should be well fed.

2) Intensive use and protection of land, water, and natural resources. As population density increases, concern for water supply and water quality will equal concern for food. Wolman (6) predicts that water withdrawals in the United States will increase 3 fold between 1960 and 2000. Farmers and ranchers are the first proprietors of most rainfall, which also supplies urban citizens. Use of water may increase more rapidly in rural, agricultural states than in urban areas. In Kansas, withdrawal of water is expected to quadruple from 3.5 to 14.2 million acre feet between 1965 and 2000 with use by agriculture increasing at a rate double that of municipalities and industry (2). Where agriculture uses the lion's share of the water, farmers can expect increasing scrutiny as competition for water increases.

3) Ecological and environmental awareness and responsibility. Although agronomy graduates serve in each of Eyring's six areas, environmental quality demands immediate attention of the graduates and of those who plan curriculums leading to the baccalaureate degree. Public concern with the environment is heightened by high school biology courses, proposed governmental reorganization, new laws and regulations, and by intimate association with the out-of-doors most agricultural students experience. Such appreciation and concern can readily be developed

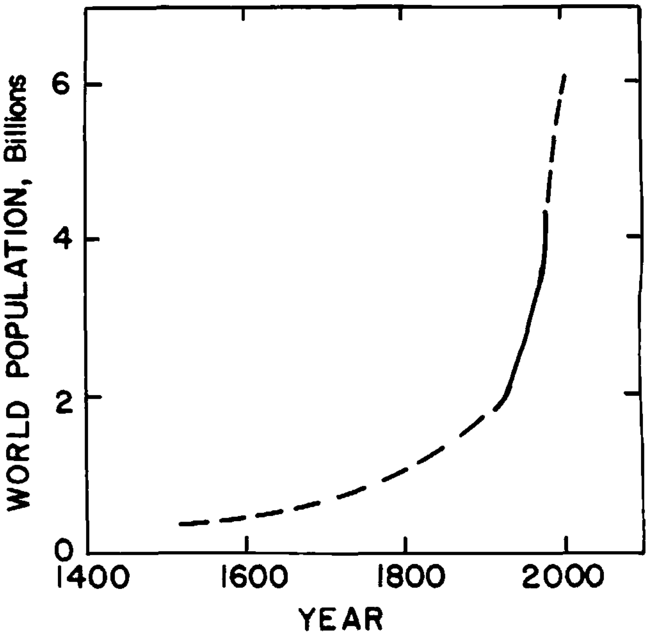


Fig. 1 World Population Estimates between 1500 and 2000 A.D.

through well designed curriculums and courses into both desire and ability to solve environmental problems. In some schools; e.g., Michigan State University, concern for the environment centers in the College of Agriculture. At others, emphasis on commodity production stifles such interest, and concern for "ecology, natural resources, and environment" is centered in biology and related departments and colleges.

Well known environmental problems such as excessive evapotranspiration, increased salinity in irrigation-return flows, nonpolluting disposal of feedlot wastes, and possible contamination of ground and surface water by pesticides and agricultural chemicals will need additional attention.

Improved technologies for intensive resource use and food production will continue to be the central concern of agronomists on a global basis. However, in advanced countries practices to conserve environmental quality will become as *common* as fertilizer and pesticide applications.

Robert M. Alexander (1) believes "The critical issue today is the nature, speed, and extent to which the physical world is changed to suit man's purpose. Science is providing, at a rapidly accelerating rate, the knowledge base on which new technologies can be developed . . . The side effects no longer are . . . secondary issues . . . (but) are now primary criteria in the consideration of new technologies".

Changing the ecological balance, eradicating unproductive species, improving productive varieties, and using agricultural chemicals that alter the environment have been accepted experiemental and production tactics with crops and soils. That they are no longer accepted simply means that training students to deal with the social and ecological consequences of agronomic practices may well be the greatest challenge of this decade. Increasingly, agriculture students must consider such complex problems as pollution and environmental degradation, which have no precise answers and yet must be dealt with (e.g., by legislation, regulation, or taxation).

Dr. W. D. Kemper[4] suggested model building as a practical way to integrate complex physical, biological, and social problems. Comprehensive models of the nutrient, heavy metal, or pesticide balance of entire watersheds would have important social implications. Completed models demonstrate where data or precision is inadequate, identify needed areas of research, and provide a basis for rational decisions.

Other solutions also have been suggested. A presidential task force at Colorado State University[5] concluded that the term "environment" was too broad to serve as a focus for a professional major. A person with a bachelor's degree in environment likely would be unemployable. Yet "environment" had enough appeal that the C.S.U. Natural Resources Center was redesignated the Environmental Resources Center. An "environmental studies" minor was proposed as an additional choice for general but not for professional education. Such traditional departments as agronomy likely will continue to play major roles in training professionals to deal with discipline-related environmental and ecological problems.

Focal Points for Curriculums

Focal points in the curriculum are important considerations. In 1966 a Natural Resources Conservation and Use (NRC) Curriculum was organized in the College of Agriculture, Kansas State University (KSU) with three options: Soil and Water Conservation, Conservation of Recreational Areas, and Economics of Conservation. The first students enrolled in 1967; the NRC curriculum now ranks 11th in total enrollment of 23 departments and curriculums in the College of Agriculture. Just 4 years after NRC was started 55 percent of those in soils in the KSU Department of Agronomy were from the soil and water option of the NRC curriculum. Educators should take advantage of current interest in natural resources, ecology, and environment.

Role of Socio-Economics

After evaluating the NRC curriculum at KSU, L. M. Reid[6] recommended elimination of the economics option while buttressing the soil and water and recreation options with geo-politics (i.e., training in the socio-economics and politics of natural resources). Agronomy deals with renewable natural resources and would greatly benefit by using well chosen geo-political courses. Lack of suitable courses in political and social sciences is a serious deterrent to that approach.

Ecological principles often are involved when geo-politics invades the natural resources realm. Agronomy and agricultural faculties can contribute significantly from their field of expertise by promoting serious study and rational judgment pertinent to social and ecological problems. To keep educational objectives relevant professors should venture from the safety and honor of precise, researchable answers to the everyday, marketplace arena where natural resource problems involve real people and controversy. Here, decisions are less amendable to the precision of the scientific method; therefore, sound judgment and common sense are attributes which should be objectives of and result from participation in our educational system.

Self Analysis

Curriculum evaluation requires internal analyses of courses, instructors, enrollment, student choice of courses, and job opportunities so educational objectives will serve both present and future needs. The following is an analysis of conditions related to the KSU Agronomy curriculum.

Student Enrollment: Between 1961 and 1970 the number of agriculture students in the system of state universities and land grant colleges increased 1.6 times; in the College of Agriculture at KSU, 1.8 times; and in plant science and beginning soils cours-

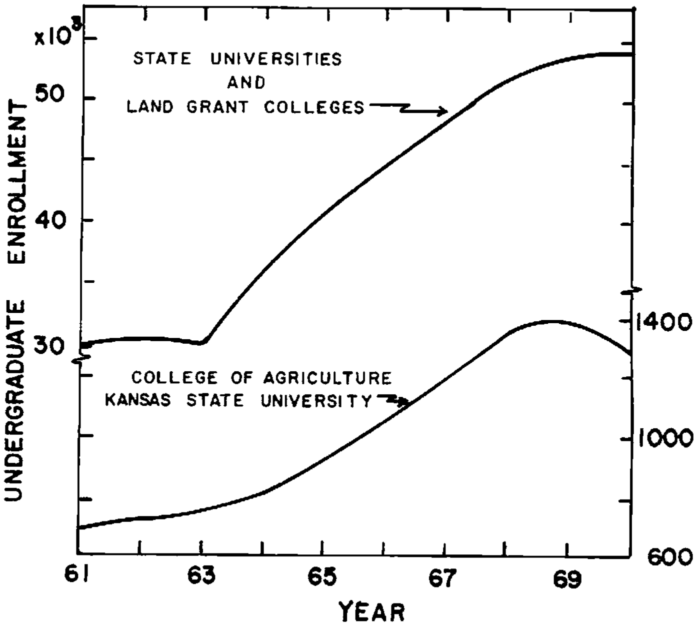


Fig. 2 Undergraduate Enrollment in Agriculture in 4-year State Universities and Land Grant Colleges and at Kansas State University.

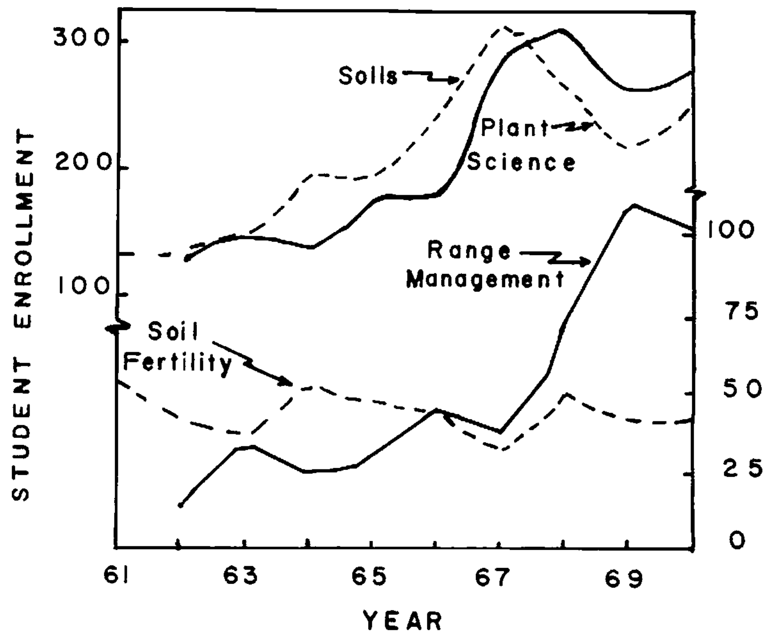


Fig. 3 Student Enrollment in Selected Agronomy Courses at Kansas State University between 1961 and 1970.

es 2.0 times, Figures 2 and 3. The importance of establishing rapport and meeting student needs is evident in Figure 3. Before 1967 a distinguished range scientist taught range management. Enrollment increased steadily between 1961 and 1967. In 1967 a new staff member changed the course to more closely meet the needs of animal science students and enrollment tripled (from 40 to 120) in 4 years.

Enrollment in soil fertility remained relatively constant over a 9-year period notwithstanding increases in total student enrollment, Figure 3. Senior student interviews revealed a high degree of satisfaction with course content and instructor performance. Changing the course schedule in 1967 from twice to once-per-year probably depressed total enrollment in the course.

Student Opinion: Duane Acker,[7] Dean of Agriculture, South Dakota State University, suggests "... 80 to 85 percent of pressures ... for curriculum change are "teacher" orientated ... and the pressure for change results from the failure of a teacher to make his course effective and appropriate."

Administrators can quickly pinpoint student dissatisfaction or approval of instructors and courses through senior interviews. Seniors welcome an opportunity to evaluate curriculums and teachers; comments are frank, refreshing and often unanimous. KSU seniors are agreed that a Crop Production course is needed in the curriculum but object to the historical aspects of the course. "Outdated" is their term for crop history. Management of Irrigated Soils was criticized by students in the production option for emphasizing science rather than management.

Reassignment, reorientation, and reward of teachers is an important facet of curriculum review.

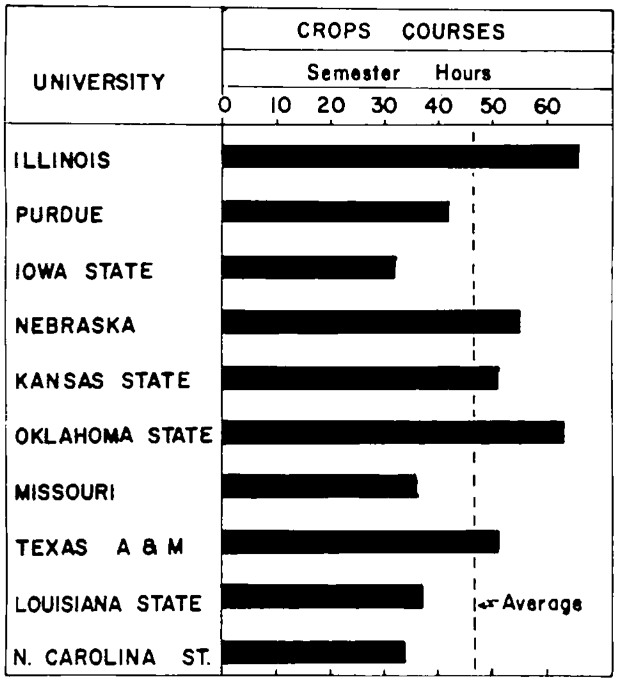


Fig. 4 Structured Crops Courses Offered at Selected Universities in 1970.

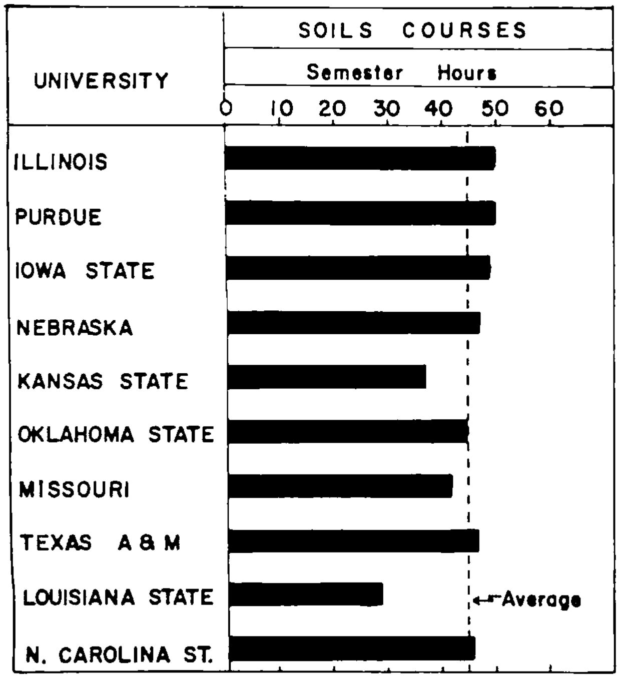
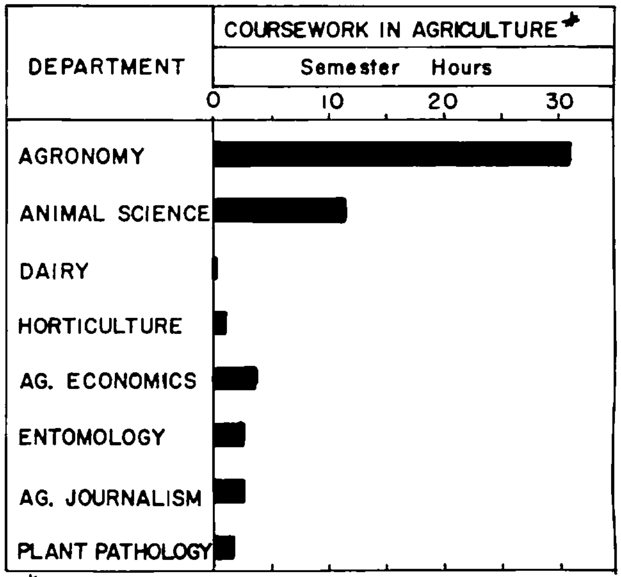


Fig. 5 Structured Soils Courses Offered at Selected Universities in 1970.

Course Offerings and Selection: Figures 4 and 5 show the time devoted to structured crops and soils courses at 10 selected universities (Courses with subject matter in both *crops and soils* like Soil-plant-water Relationships are not included in the totals reported). Instruction in crops averaged 47 semester hours. The 66 semester hours devoted to 18 crops courses at the University of Illinois is more than double the 32 equivalent semester hours for 15 crops courses at Iowa State University. Both institutions produce able graduates, yet the total time they devote to crop instruction differs significantly. Iowa State is on a quarter system while Illinois is on the semester system. Many universities likely could reduce teaching loads by judicious credit allocation and course selection and still produce quality graduates.

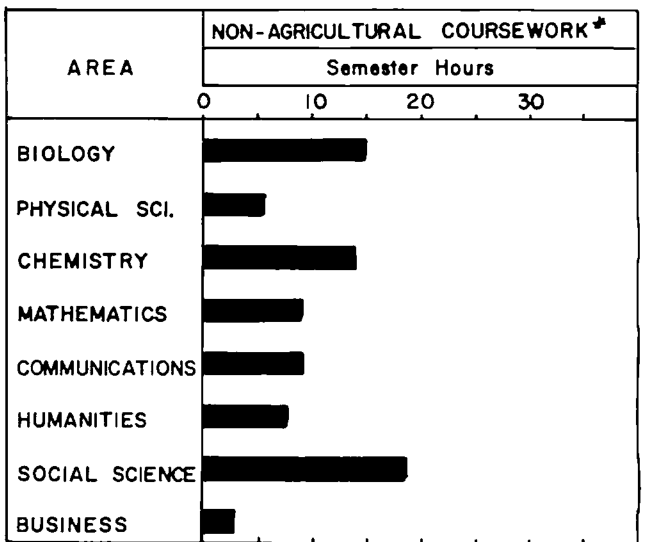
Course proliferation is of concern to both faculty and administrators: total course work in agriculture and agronomy often is greater than is provided for in the budget. Research suffers as a consequence.

Course work in soils at the 10 institutions (Fig. 5) averaged 45 semester hours and ranged from 9 courses and 29 hours at Louisiana State University to 17 courses and 50 semester hours at Purdue University. Total time devoted to soils at 8 of the 10 institutions was within ±5 semester hours of the average.



*Average for 1967-1970

Fig. 6 Average Coursework Taken in Selected Agricultural Departments by Agronomy Students in the Production Option at Kansas State University between 1967 and 1970.



*Average for 1967-1970

Fig. 7 Average Coursework Taken in Selected Areas by Agronomy Students in the Production Option at Kansas State University between 1967 and 1970.

KSU Agronomy majors are offered 5 options. The proportion of students in the Production, Business and Industries, Crop Science, Soil Science, and Range Management options are 43, 16, 20, 20, and 1 percent, respectively. Averages of courses taken in selected agricultural and nonagricultural areas by students graduating in the production option between 1967 and December 1970 are shown in Figures 6 and 7, respectively. Fifty-seven hours of agricultural and 84 hours of nonagricultural courses were chosen. Production-oriented agronomy students averaged 11 courses in agronomy, three in animal science, one in agricultural economics and less than one course each in all other agricultural departments. The concentration of courses in agronomy and the paucity in departments outside agronomy indicates overspecialization.

Nonagricultural courses are more evenly distributed with 5 courses in biological science, 2 in physical science, 3 in chemistry, 3 in math and statistics, 3 in communications, 2 in humanities, and 6 in social science, but less than 1 in business, indicating overemphasis of social science and underemphasis of business in nonagricultural areas. In 1968 commercial farms in the 48 contiguous states averaged $100,400 in value (5). Also 49 percent of the 1964 agricultural graduates are employed in business and industry. Lack of business training would seriously handicap the manager of a commercial farm and those seeking employment in agribusinesses.

Student Placement: Job opportunities always should help determine curriculum requirements. The College Placement Council reported this April that offers by business and industry are down 61 percent from March, 1970 (4). Table 1 shows where 1970, 1964, and 1960 agricultural graduates are working. National averages are also given. The percentage of graduates farming and managing farms is declining steadily while the proportion entering business and industry remains high.

Table 1. Placement of Bachelor of Science Graduates in Agriculture at Kansas State University and the United States for years indicated.

	Percentage of Graduates			
	Kansas State University			Nation
	Year			
Placement	1970*	1964**	1960***	1969
Graduate study	17	1	-	21
Education	9	20	23	12
Farm & farm mgnmnt.	7	14	17	9
Business & industry	30	49	45	18
Government	4	9	13	8
Military	24	7	-	21
Other	9	-	2	11

* From Placement Records: 65% response to survey.
** 71 percent response to survey.
*** 65 percent response to survey. Thirty percent of students responding obtained an advanced degree.

Time Requirements for a Professional Degree: "At least a Master's degree for professional competence," is an idea gaining acceptance among an increasing percentage of research orientated faculty. They also think of hard science alone as being first class. However, curriculums that do not provide professional competence for B.S. graduates are deficient for the 70 percent of agricultural students who do not take advanced degrees. Our students still come to college bent on professional preparation rather than general education. R. L. Kohls[8] observed, the vast majority of those who will manage our farms and businesses and who will govern our society will do so without the benefit of graduate education.

A 1967 study showed that only 10 percent of KSU agricultural graduates completed requirements for the B.S. degree in 8 semesters, Table 2. Almost half took over 9 semesters and agronomy students took the longest, 9.6 semesters. In many instances societal and individual needs would be served better by curriculums designed to facilitate graduation in 8 semesters. An average undergraduate course load at KSU is 14.1 hours. Eight semesters @ 15 hours per semester totals 120 hours. The College of Arts and Sciences at KSU recently reduced graduation requirements to 120 hours, and Agriculture reduced graduation requirements from 132 to 126 hours. Subsequently, between 1967 and 1970 agronomy students averaged 8.6 semesters and 138 hours before graduating. Further reduction in graduation requirements by reducing overspecialization in the major and redistributing agriculture and nonagricultural courses seems desirable.

Table 2. Semesters required for 1967 graduates to earn the B.S. degree in Agriculture at Kansas State University.

Number of Semesters	Number of graduates	Percent	Cumulative percentage
8	13	10.4	10.4
8 + summer	9	7.2	17.6
9	49	39.2	56.8
9 + summer	8	6.4	63.2
10	33	26.4	89.6
10 + summer	7	5.6	95.2
11	4	3.2	98.4
11 + summer	2	1.6	100.0

Summary and Conclusions

About 70 percent of agriculture students do not take advanced degrees so curriculums should be designed for the majority of students to complete professional training in 4 years. Agronomy students at Kansas State University tend to over-specialize in their major, take few courses in other agriculture departments, average 8.6 semesters of study before graduating, and, except for those in the Business and Industry option, lack business training. Conversely, they take 47 percent more courses in Arts and Sciences and other colleges than in the College of Agriculture. Adequate hours in communications and biological, physical, and social sciences are obtained. Social and political science courses applicable to natural and renewable resources are desired but not readily available.

Serious consideration should be given to reducing graduation requirements to 120 hours while increasing courses in the College of Business Administration, and evaluating courses and total time devoted to the geo-political area.

Ecological principles are often involved at the interface relating social sciences to natural and renewable resources. Within their own specialty agronomy faculty members can contribute significantly to interrelated social and ecological problems by encouraging students to study, by building biologic-natural resource-socio-economic models, and by using rational judgment.

Today's agronomy student will be in the prime of life and influence in the year 2,000. Traditional roles of agronomists are: 1) producing food and fiber; and 2) intensively using and conserving land, water, and natural resources. The promotion of ecological and environmental awareness urgently needs to be added to that list. Training students to deal with the social and ecological consequence of agronomic practices on the soil-plant-water-atmosphere continuum may well be the greatest challenge of this decade. Agronomy faculties, among the best trained for the job, should be in the forefront of that effort.

Bibliography

1. Alexander, R. M. Social Aspects of Environmental Pollution. Agricultural Science Review 9:9-18. U.S. Department of Agriculture. 1971.
2. Future Irrigation Water Demands. Kansas Water Resources Board Bul. 11. 21 pp. 1969.
3. Growth of the World's Urban and Rural Population 1920-2000. Dept. of Economic and Social Affairs. Population Studies No. 44. United Nations. New York. 124 pp. 1969.
4. Men's Salary Survey. Report 2, the College Placement Council, Box 2263, Bethlehem, Pennsylvania. March 1971.
5. Menzie, E. L. Agriculture in a Changing Environment. Progressive Agriculture in Arizona. Vol. XXII; No. 5. pp. 12-13. University of Arizona. 1970.
6. Wolman, Abel. Water Resources: A Report to the Committee on Natural Resources. National Academy of Science - National Research Council. Pub. 1000-B. 1962.

---

[1] Contribution No. 1199 Department of Agronomy, Kansas Agricultural Experiment Station, Manhattan, Kansas.

[2] Professors of Soils; Weed Science; Soil Morphology and Acting Head; respectively. Kansas State University.

[3] Dean of the Graduate School, University of Utah. Personal communication.

[4] Director, U.S. Soils Laboratory, Beltsville, Md. Personal communication.

5 Personal communication with Professor Henry P. Caulfield, Colorado State University

6 Head, Dept. of Recreation and Parks, Texas A & M University. Personal communication.

7 Duane Acker. Trends in Agriculture Curricula. Mimeo. Summary Proceedings: Regional Conference on Undergraduate Education in the Biological, Physical, and Social Sciences. (N.C. Region) 1968-69. Commission on Education in Agricultural and Natural Resources. National Academy of Sciences. Washington, D.C. 1971.

8 R. L. Kohls. Trends in Agricultural Curricula. Mimeo. Summary Proceedings: Regional Conference on Undergraduate Education in the Biological, Physical, and Social Sciences. (N.C. Region) 1968-1969. Commission on Education in Agriculture and Natural Resources. National Academy of Sciences. Washington, D. C. 1971.

THE BALANCE OF NATURE MYTH

Jerry Caulder, Monsanto Company

On the morning of May 14, 1607, three ships, the **Susan Thompson**, **Godspeed** and **Discovery**, sailed up the James River from Cape Henry and put 100 men and four boys ashore at a point on a little peninsula.

This swampy, disease-ridden place was named Jamestown by the group of settlers who, by 1609, were on the verge of starvation and death from pneumonia, dysentery or malaria. This was the scene when man first set foot on the eastern coast of North America and began to upset "the balance of nature", which is often referred to in literature, but never precisely defined. No student of natural science, particularly of animal or plant ecology, could ever subscribe to a "balance of nature". The serious observer knows that animal and plant communities are in a dynamic state. While temporary equilibrium may occur and a given ecosystem may seem in balance, it is always progressing toward a climax condition. For example, if a "balance" ever existed, why do not animals and plants of the pleistocene or tertiary epochs inhabit the earth today? Why are not a few miserable men and women still huddled in caves cracking bones to obtain every morsel of nourishment from hard-gotten game? If nature were to ever strike its "balance", this was the time – man's influence on the environment was negligible.

The date when man first began to control or influence the environment is one of conjecture.

Early man and most plants and animals had to accept the environment as they found it and thus regularly became victims of "change".

The key word here is "change". We've all heard of the saber-toothed tiger, the dinosaur, the carboniferous forest? These organisms could not accept change. If nature were "in balance", could there be dramatic and long lasting changes? No, but we know that there is change – frequently abrupt, and sometimes catastrophic.

Plants and animals, if they are to survive, must either adapt to the environment or adapt the environment to their needs. Many plants and animals can adapt to the environment, but only man has successfully been able to alter the environment to fit his needs. Most plants and animals have developed habits and mechanisms to accommodate certain changes.

Many plants are able to survive cold weather because they produce seeds that remain dormant during the cold months. Some seeds, produced by desert plants, only germinate when they receive enough water to insure a complete life cycle.

With the animals, we look at the success of the crow. Its feeding habits are quite varied, so it adapts to many different diets depending on what food is available. On the other hand, the Everglade Kite, a bird that feeds exclusively on a giant fresh-water snail, will become extinct if anything happens to the snail. It cannot accept change.

Still other species have learned to avoid seasonal scarcity of food by migrating long distances. Water fowl, which nest in Canada, winter in the Gulf states and Mexico. Whales, seals and other aquatic animals have similar migration habits. Others choose to avoid adverse conditions by aestivating during high temperatures, like the bullfrog or box turtle, or hibernating during the winter like the bear or chipmunk.

Despite these many adaptations, most species of animals that have existed over the millions of years this earth has supported life have lost the battle to change and become extinct. Of all the animals that have existed on earth, it is estimated that 99% are now extinct. No, and I repeat, no 50 year period in recorded history is without numerous examples of animal species that passed from the scene – a balance of nature did not prevail. It is important to note that every niche capable of supporting life has been filled by a differing species. So the extinction of species is a naturally occurring phenomena. Nature is constantly changing. We should look at the modifications in plant cover or habitat that led to the extinction, and these changes should be judged on their merits – not what they caused – but what good can come from them. Who, among you, would be willing to live in the so called "natural" environment that existed at the time of Jamestown?

Nature is a difficult and unfeeling taskmaster if one is wholly dependent on her whims.

Primitive man existed, like any other animal, as a part of the environment, exerting very little influence on it. As time passed, man found that not only could he adapt to a hostile environment, but that he could change the environment to fit his needs.

Probably man's first significant step toward controlling his environment was the use of fire. This enabled him to move into the temperate regions that were formerly too cold. The temperate regions are our most productive ones, but man adapted to the cold winters that had prevented him from inhabiting these areas; man altered his environment with fire.

With the ability to think, man has, through the ages, been able to perfect means of improving his environment to contribute to his comfort and health.

Early man's thoughts centered around one simply thing – survival. And to survive, he needed two things, food and shelter. He needed shelter from both the elements and predators. He needed food for energy. This energy enabled him to gather more food – he had no time for other things in life.

Men, like other animals, began to establish "territories" or areas in which they felt safe from predators, but as wild game became scarce, they had to move and were once again exposed to predators.

This probably led to the first simple type of farming – man domesticated animals and planted a few grain crops. This way he had a supply of food with a minimum amount of exposure to his enemies.

This is essentially the way the Indians were living at the time of the Jamestown settlement. While the Indians in the early 1600's had carved small cultivated fields out of the land for corn, squash and tobacco, the men of Jamestown set into motion a pioneering, organized program of land use (not always the best, but man could learn from mistakes – nature in perfect balance would not allow a species to make mistakes.)

The history of agriculture can be divided into roughly three phases:
(1) man and animal tilling the soil; (2) man, animals and machines tilling the soil (1850); and, (3) man, machines and chemicals (1940).

In the first phase of farming, man and animal, there was little else in life. A man could barely produce enough food for his family and animals, so most people were farmers.

As man moved into the second phase of agriculture, man and machine, he could